UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,353	01/23/2004	Randy Hoffman	200311332-2	7102

22879 7590 11/30/2006

HEWLETT PACKARD COMPANY
P O BOX 272400, 3404 E. HARMONY ROAD
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

EXAMINER	
MONDT, JOHANNES P	

ART UNIT	PAPER NUMBER
3663	

DATE MAILED: 11/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/763,353	HOFFMAN ET AL.
	Examiner	Art Unit
	Johannes P. Mondt	3663

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 September 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *4,6-9,11,12,14,15,19,21-24,26,29,31-39,48 and 50-67* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *4, 6-9, 11-12, 14-15, 19, 21-24, 26, 29, 31-39, 48 and 50-67* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendment filed 9/7/06 forms the basis for this action. In said amendment applicant substantially amended all pending claims and introduced new claims 50-60. Comments on Remarks submitted with said amendment are included below under "Response to Arguments".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. ***Claims 4, 6-9, 11, 26, 29, 31-36, 48 and 50-63*** are rejected under 35 U.S.C. 102(e) as being anticipated by Carcia et al (US 2004/0127038 A1) (cited previously; IDS).

Carcia et al teach a semiconductor device (thin film transistor; see title), comprising: a source electrode ("Source", Figure 3, also: inherent in thin film transistor); a drain electrode ("Drain", Figure 3, equally inherent on thin film transistor), a channel coupled to the source and drain electrode (zinc oxide comprising semiconductor layer; see

Figure 3 and [0042]; said channel also is inherent in any thin film transistor) and comprised of a ternary compound containing zinc, tin and oxygen (see [0010]), where at least a portion of the channel is formed from a zinc-tin oxide compound having the stoichiometric formula Zn2SnO4 (namely: one of said "combinations", especially the combination $2ZnO + SnO_2 \rightarrow Zn_2SnO_4$); and a gate electrode ("Gate" in Figure 3; equally inherent in any thin film transistor) configured to permit application of an electric field to the channel (which is the very function of a gate).

On claim 6: the limitation "substantially amorphous" is met by Carcia et al, because inherently sputtering creates substantially amorphous forms of zinc oxide based oxides, as witnessed for example by Henrichs (US 2003/0185266 A1) ([0046], not cited here other than for establishment of fact; and cited previously).

On claim 7: one or more of the source, drain and gate electrodes are fabricated so as to be at least partially transparent (all of gate, drain and source electrodes are made of transparent zinc oxide; see Example 7, [0053]).

On claims 8-9: the limitations of claims 8 and 9 are met by virtue of the finite dissociation constant of Zn_2SnO_4. For the finiteness of said dissociation constant the examiner has previously taken official notice. Accordingly, the finite dissociation constant of Zn2SnO4 is considered Prior Art admitted by Applicant (cf. MPEP 2144.03[R-1]).

On claim 11: The limitation "is adapted to be deposited using an RF sputtering process", is only of patentable weight in as much as the method steps distinguish the final structure, and to the extent not impacting final structure are

taken to be product-by-process limitations and non-limiting. A product by process claim is directed to the product per se, no matter how they are actually made. See In re Fessman, 180 USPQ 324, 326 (CCPA 1974); In re Marosi et al, 218 USPQ 289, 292 (Fed. Cir. 1983), and In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make clear that it is the patentability of the final structure of the product "gleaned" from the process steps that must be determined in a "product-by-process" claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old or obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or not.

In the underlying case it is therefore only parenthetically mentioned that indeed the channel of the prior art is adapted to be deposited using RF sputtering ([0010] and [0047]).

On claim 26: the examiner takes official notice that the limitation defined by this claim is inherently met, by any thin film transistor by definition of its gate. The official notice has not been traversed, and accordingly the subject matter of it is considered Prior Art admitted by Applicant (cf. MPEP 2144.03[R-1]).

On claim 29: at least a portion of the channel layer is formed from a zinc-tin oxide compound having the following stoichiometry: Zn_2SnO_4 (see [0010]).

On claim 31: the limitation "substantially amorphous" is met by Carcia et al, because inherently sputtering creates substantially amorphous forms of zinc oxide based oxides, as witnessed for example by Henrichs (US 2003/0185266 A1) ([0046], not cited here other than for establishment of fact).

On claim 32: one or more of the source, drain and gate electrodes are fabricated so as to be at least partially transparent (all of gate, drain and source electrodes are made of transparent zinc oxide; see Example 7, [0053]).

On claims 33-34: these further limitations, i.e., the same as of claims 8 and 9, are met by virtue of the finite dissociation constant of Zn_2SnO_4. For the finiteness of said dissociation constant the examiner has previously taken official notice. Applicant has not challenged said official notice. Accordingly, the finite dissociation constant of Zn2SnO4 is considered Prior Art admitted by Applicant (cf. MPEP 2144.03[R-1]).

On claim 35: one or more of the source, drain and gate electrodes are fabricated so as to be at least partially transparent (all of gate, drain and source electrodes are made of transparent zinc oxide; see Example 7, [0053]).

On claim 36: The limitation "is adapted to be deposited using an RF sputtering process", is only of patentable weight in as much as the method steps distinguish the final structure, and to the extent not impacting final structure are taken to be product-by-process limitations and non-limiting. A product by process claim is directed to the product per se, no matter how they are actually made. See In re Fessman, 180 USPQ 324, 326 (CCPA 1974); In re Marosi et al, 218 USPQ 289, 292 (Fed. Cir. 1983), and In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make clear that it is the patentability of the final structure of the product "gleaned" from the process steps that must be determined in a "product-by-process" claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old or obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or

not. In the underlying case it is therefore only parenthetically mentioned that indeed the channel of the prior art is adapted to be deposited using RF sputtering ([0010] and [0047]).

On claim 48: Carcia et al teach a display (their claim 16) comprising: a plurality of display elements configured to being capable to operate collectively to display images, wherein each of the display elements includes a semiconductor device configured to control light emitted by the display element (namely: the transparent oxide semiconductor transistors; see their claim 16), the semiconductor device including: a source electrode ("Source", Figure 3, also: inherent in thin film transistor); a drain electrode ("Drain", Figure 3, equally inherent on thin film transistor), a channel coupled to the source and drain electrode (zinc oxide comprising semiconductor layer; see Figure 3 and [0042]; said channel also is inherent in any thin film transistor) and comprised of a ternary compound containing zinc, tin and oxygen (see [0010]), where at least a portion of the channel is formed from a zinc-tin oxide compound having the stoichiometric formula Zn2SnO4 (namely: one of said "combinations", especially the combination $2ZnO + SnO_2 \rightarrow Zn_2SnO_4$); and a gate electrode ("Gate" in Figure 3; equally inherent in any thin film transistor) configured to permit application of an electric field to the channel (which is the very function of a gate).

On claim 50: Carcia et al teach a semiconductor device (TFT), comprising:

a source electrode, a drain electrode, a channel coupled to the source electrode and the drain electrode and comprised of a ternary compound containing zinc, tin and oxygen ([0010]); and a gate electrode by definition configured to permit application of an

electric field to the channel (N.B.: only its capability to do so is patentable, and said capability is inherent in "gate" of a field effect transistor, hence also of "gate" of a thin film transistor.

On claims 51-52: Carcia et al teach that at least a portion of the channel is formed from a zinc-tin oxide compound having the following stoichiometry: $Zn_xSn_yO_4$ where x, y and z have positive (hence automatically non-zero) values, in particular ZnSnO3 ([0010]), because Carcia et al teach any combination of four different binary oxide compounds including ZnO and SnO_2, of which $ZnSnO_3$ is one of six such ternary combinations.

On claim 53: For j=0.5, which is in the claimed range, the stoichiometric formula corresponds to a single compound, namely $ZnSnO_3$ because only the ratios of the stoichiometric parameter values have physical meaning.

On claim 54: one or more of the source, drain and gate electrodes are fabricated so as to be at least partially transparent (all of gate, drain and source electrodes are made of transparent zinc oxide; see Example 7, [0053]).

On claim 55: the gate electrode in Carcia et al is physically separated from the channel by a dielectric material (SiO_2 in Figure 3, [0046]).

On claim 56: Carcia et al teach a semiconductor device (thin film transistor; see title), comprising:

a source electrode ("Source", Figure 3, also: inherent in thin film transistor);

a drain electrode ("Drain", Figure 3, equally inherent on thin film transistor),

a gate electrode, and

means for providing a channel configured to permit movement of electric charge therethrough between the source and drain electrodes in response to a voltage applied at the gate electrode (zinc oxide comprising semiconductor as delineated by [0009]-[0010]; see also [0042] and [0053]); said source electrode, drain electrode, gate electrode and channel being inherent in any thin film transistor, being a field effect transistor), the means for providing a channel formed at least in part from a ternary compound containing zinc, tin and oxygen, i.e., Zn_2SnO_4 (see [0009]-[0010]).

On claims 57-59: said means, i.e., said semiconductor being a ternary compound $Zn_xSn_yO_z$ (see again [0009]-[0010]), in particular, through the taught combination of ZnO and SnO_2: $ZnSnO_3$ (loc.cit.) (hence meeting claim 58), which is identical to $(ZnO)_j(SnO2)_{1-j}$ for j=1/2, which is in the range as claimed (hence meeting claim 59).

On claims 60-63: Carcia et al teach a thin film transistor([010] and [0031]-[0055]), comprising: a gate electrode ("Gate", Figure 3), a channel layer from a zinc-tin oxide material (namely: Zn_2SnO_4 among other) (the ZnO base semiconductor layer comprises a channel in operation, hence is a channel layer); a dielectric material disposed between and separating the gate electrode and the channel layer (SiO2 layer in Figure 3); first and second electrodes as claimed being met by the source ("Source"; Figure 3) and drain ("Drain") electrodes and disposed adjacent the channel layer on a side of the channel layer opposite the dielectric material, such that the channel layer is disposed between and electrically separates the first and second electrodes (thus far this claim limitation merely recites inherent properties of a thin film transistor with insulated gate), where, with regard to claim 61 at least a portion of the channel layer is formed from a

zinc-tin oxide compound having the stoichiometry Zn_2SnO_4 ([0010]); the combination $ZnO + SnO_2 = ZnSnO_3$ also belongs to the taught combinations by Carcia et al (meeting claim 62), which is identical to $(ZnO)_j\ (SnO2)_{1-j}$ for j=1/2, which is in the range as claimed (hence meeting claim 63).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. ***Claims 19, 21, 22 and 24*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Carcia et al (US 2004/0127038 A1) (cited previously, and IDS) in view of Taylor (4,521,698) (cited previously).

On claim 19: Carcia et al teach a three-port device (source, drain and gate being the three ports), comprising: a source electrode ("Source"; Figure 3); a drain electrode ("Drain"; cf. Figure 3); a gate electrode ("”Gate"; Figure 3); furthermore, in reference to the claim limitation "means for providing a channel configured to permit movement of electric charges there-through between the source electrode and the gate electrode, intended use and other types of functional language must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of

performing the intended use, then it meets the claim. In re Casey, 152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963).

In the underlying case, it is thus only parenthetically mentioned that indeed the prior art by Carcia et al teaches a means for providing channel disposed between the source electrode and the drain electrode (said means being a semiconducting oxide layer comprising zinc separating source and channel with a gate electrode sufficiently nearby to produce a channel when given a voltage that either accumulates, depletes or inverts the interface between the semiconducting oxide layer and a dielectric layer separating gate from semiconductor oxide layer; furthermore, channel is inherent in the thin film transistor by Carcia et al and is implied by the existence of a gate near a channel forming substance, as the ZnO area in Figure 3), inherently permitting movement of electric charge there-through between source and drain in response to a voltage applied at the gate electrode, the means for providing a channel formed at least in part from a ternary compound containing zinc, tin and oxygen, where the means for providing a channel includes means for providing a semiconductor formed from a zinc-tin oxide compound having the stoichiometry Zn_2SnO_4.

Also, the limitation "means for providing a semiconductor" (second line from below) constitutes a product-by-process limitation, because, while said channel comes about through a method of use (application of voltage to gate), the "means for providing a semiconductor is a limitation on how to make said semiconductor. The limitation is only of patentable weight in as much as the method steps

distinguish the final structure, and to the extent not impacting final structure are taken to be product-by-process limitations and non-limiting. A product by process claim is directed to the product per se, no matter how they are actually made. See In re Fessman, 180 USPQ 324, 326 (CCPA 1974); In re Marosi et al, 218 USPQ 289, 292 (Fed. Cir. 1983), and In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make clear that it is the patentability of the final structure of the product "gleaned" from the process steps that must be determined in a "product-by-process" claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old or obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or not.

Carcia et al do not necessarily teach the limitation on movement of electric charge between source and gate electrode in response to voltage (lines 6-8). *However, it would have been obvious to include said limitation in view of Taylor, who, in a patent on insulated gate field effect transistors, namely MOSFETs*, hence related art, teach the use thereof wherein gate and drain are conductively connected so as to avoid hot electron effects (title, abstract, Figure 3; in particular transistor 224; and columns 1-3).

Motivation to include the teaching by Taylor at least derives from the generic undesirability of hot electron effects, i.e., effect whereby the acceleration of electrons due to the voltage head between source and drain leads to electron-electron collisions upon the impact on the drain region of accelerated electrons from the channel, resulting in the excitation of valence electrons into the conduction band,

i.e., to electron-hole pair production, resulting, due to the relatively large effective mass of the holes, in unwanted further bias of the semiconductor region near the channel.

On claim 21: the limitation "substantially amorphous" is met by Carcia et al, because inherently sputtering creates substantially amorphous forms of zinc oxide based oxides, as witnessed for example by Henrichs (US 2003/0185266 A1) ([0046], not cited here other than for establishment of fact).

On claim 22: one or more of the source, drain and gate electrodes are fabricated so as to be at least partially transparent (all of gate, drain and source electrodes are made of transparent zinc oxide; see Example 7, [0053]).

On claim 24: the semiconductor device by Carcia et al further comprises a dielectric disposed between and physically separating the gate electrode from the semiconductor layer that provides the channel (SiO2 layer in Figure 3). Furthermore, means for providing a dielectric" constitutes a product-by-process limitation, because said means is not a structural aspects but instead merely a means for providing, i.e., a means for making a structural component. The limitation is only of patentable weight in as much as the method steps distinguish the final structure, and to the extent not impacting final structure are taken to be product-by-process limitations and non-limiting. A product by process claim is directed to the product per se, no matter how they are actually made. See In re Fessman, 180 USPQ 324, 326 (CCPA 1974); In re Marosi et al, 218 USPQ 289, 292 (Fed. Cir. 1983), and In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make clear that it is the patentability of the final structure of the

product "gleaned" from the process steps that must be determined in a "product-by-process" claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old or obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or not.

3. ***Claims 12 and 37*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Carcia et al as applied to claim 50 and 56, respectively, in view of Hong et al (6,674,495 B1) (cited previously).

As detailed above, Carcia et al anticipate claims 50 and 56. Carcia et al do not necessarily teach the further limitation that the source and drain electrodes are formed from an indium-tin oxide material. However, it would have been obvious to include this further limitation in view of Hong et al, who, in a patent on a thin film transistor array panel for display, hence analogous art (see title and abstract), teach the source and drain electrodes to be ITO (i.e., indium-tin oxide) electrodes (see column 20, lines 25-37, and e.g., Figures 1 and 23) in a patent in which ITO and zinc oxide are both respectively cited for conductivity and transparency, two important advantages for electrode material in a display (see, e.g., columns 9 and 20). Inherently, source and drain electrodes in any thin film transistor, in fact in any field effect transistor, are separate from one another. Applicant is reminded in this regard that it has been held that mere selection of known materials generally understood to be suitable to make a device, the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416. Furthermore, the limitations "formed from" and "patterned" constitute product-by-process limitations and

are only of patentable weight in as much as the method steps distinguish the final structure, and to the extent not impacting final structure are taken to be product-by-process limitations and non-limiting. A product by process claim is directed to the product per se, no matter how they are actually made. See In re Fessman, 180 USPQ 324, 326 (CCPA 1974); In re Marosi et al, 218 USPQ 289, 292 (Fed. Cir. 1983), and In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make clear that it is the patentability of the final structure of the product "gleaned" from the process steps that must be determined in a "product-by-process" claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old or obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or not.

4. ***Claim 23*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Carcia et al and Taylor as applied to claim 19 above, and further in view of Hong et al (6,674,495 B1) (cited previously).

As detailed above, claim 19 is unpatentable over Carcia et al in view of Taylor. Carcia et al nor Taylor necessarily teach the further limitation that the source and drain electrodes are formed from an indium-tin oxide material. However, it would have been obvious to include this further limitation in view of Hong et al, who, in a patent on a thin film transistor array panel for display, hence analogous art (see title and abstract), teach the source and drain electrodes to be ITO (i.e., indium-tin oxide) electrodes (see column 20, lines 25-37, and e.g., Figures 1 and 23) in a patent in which ITO and zinc oxide are both *ex aequo* cited for conductivity and transparency, two important advantages for

electrode material in a display (see, e.g., columns 9 and 20). Inherently, source and drain electrodes in any thin film transistor, in fact in any field effect transistor, are separate from one another. Applicant is reminded in this regard that it has been held that mere selection of known materials generally understood to be suitable to make a device, the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416. Furthermore, the limitations "formed from" and "patterned" constitute product-by-process limitations and are only of patentable weight in as much as the method steps distinguish the final structure, and to the extent not impacting final structure are taken to be product-by-process limitations and non-limiting. A product by process claim is directed to the product per se, no matter how they are actually made. See In re Fessman, 180 USPQ 324, 326 (CCPA 1974); In re Marosi et al, 218 USPQ 289, 292 (Fed. Cir. 1983), and In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make clear that it is the patentability of the final structure of the product "gleaned" from the process steps that must be determined in a "product-by-process" claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old or obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or not.

5. ***Claims 14 and 38*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Carcia et al in view of Krivokapic et al (6,100,558) (cited previously).

As detailed above, Carcia et al anticipate claims 55 and 60.

Carcia et al do not necessarily teach the limitation that said dielectric material is an aluminum-titanium oxide material. *However, it would have been obvious to include said limitation as witnessed, for instance, by Krivokapic et al,* teaching a combination of Al_2O_3 and TiO_2 for the gate dielectric layer the purpose of increasing the dielectric constant of the gate oxide (Figure 19 and column 8, lines 3-26) so as to overcome adverse effects of small defects or contamination of the gate oxide material (see "Background of the Invention", col. 1). *Motivation* to include the teaching by Krivokapic et al in the invention by Carcia et al derives from the consequent reduction in defective operation.

6. ***Claims 15 and 39*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Carcia et al and Krivokapic et al as applied to claims 14 and 38, respectively, above, and further in view of Hornik et al (US 2004/0169210 A1) (cited previously).

As detailed above, claims 14 and 38 are unpatentable over Carcia et al in view of Krivokapic et al.

Neither Carcia et al nor Krivokapic et al necessarily teach the further limitation defined by claims 15 or 39, respectively.

However, it would have been obvious to include said further limitation in view of *Hornik et al,* who, in a patent on barrier material against the diffusion of hydrogen into a high dielectric constant layer such as PZT during passivation of gate oxide, teaches to protect said layer of PZT with a pair of Al_2O_3 layers with a TiO_2 layer in between (see

[0006] and [0024]). *Because PZT is also included in the teaching by Krivokapic et al as one of the gate oxide materials, it would have been obvious* to include the teaching on hydrogen diffusion barrier structure against deterioration of PZT also in the gate oxide by Krivokapic et al. To protect the PZT layer optimally it would furthermore have been obvious to provide the $Al_2O_3/TiO_2/Al_2O_3$ layer on both sides of the PZT layer, thus meeting the claim limitation. *Motivation* to include the teaching by Hornik et al derives immediately from the increased integrity resulting from the protection of the PZT against a lowering of its dielectric constant due to hydrogen diffusion.

7. ***Claims 64-67*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Carcia et al in view of Ando et al (6,184,946 B1) (cited previously).

Carcia et al teach a semiconductor device including a source electrode, a drain electrode, a channel coupled to the source electrode and the drain electrode; and a gate electrode configured to permit application of an electric field to the channel, all of the above inherent in the thin film transistor (TFT) by Carcia, and disclosed in Figure 3, Examples 1-7. Furthermore, said channel comprises a ternary compound containing zinc, tin and oxygen ([0009]-[0010]), in particular a compound having the stoichiometry ZnxSnyOz, where x, y and z have positive values (thus meeting claim 65), in particular $ZnSnO_3$ (thus meeting claim 66) which is indistinct for j=1/2 (which falls in the range as claimed) from (ZnO)j(SnO2)1-j; thus also meeting claim 67).

Carcia et al do not necessarily teach the limitation that said semiconductor device is included in a display comprising a plurality of display elements configured to operate collectively to display images, where each of the display elements includes a

semiconductor device configured to control light emitted by the display element. *However, it would have been obvious to include said further limitation in view of Ando et al, who*, in a patent on thin film transistor based applications to display technology (title and abstract), hence analogous art, teach the application of thin film transistors (TFTs) (col. 4, l. 3-25), in particular as switching elements (abstract) used for switching in a method for controlling an active matrix display (title, abstract), wherein the TFT selectively controls activation and deactivation of a pixel of the active matrix display by selectively controlling the gate voltage (cols. 1-col. 2, l. 5: that is how thin film transistor function). *Motivation* to include the teaching by Ando et al in the invention by Carcia et al derives from the obvious advantage of applying a transparent and high mobility TFT such as taught by Carcia et al to said active matrix display because little light is lost by absorption by the thin film transistor (said semiconductor layer being transparent to light; Figure 7 and discussion) while the device speed is still high as witnessed by the excellent current-voltage characteristics (i.e., mobility) (see Figures 4-9).

Response to Arguments

Applicant's arguments filed 9/7/06 have been fully considered but they are not persuasive. Although additional claims have been added examiner recognizes the essential similarity with previously cancelled claims. The reasons why applicant's arguments are not persuasive are three-fold (see considerations (1)-(3) below). In particular:

(a) <u>*Rejection of claim 4, 19, and 48*</u>:

As a first argument in traverse, applicant alleges in connection with the rejection of claims 4, 19 and 48 (page 16, Remarks) that the teaching by Carcia et al of four binary oxides including an indication of "the potential for combinations thereof" "would not be sufficient disclosure for one of ordinary skill to immediately envisage the specific ternary zinc-tin oxide combination". Applicant appears to base his argument by alleging that "an infinite number of stoichiometric combinations of the four binary oxides disclosed by Carcia et al. This argument is not persuasive because of the following considerations:

(1) Carcia does not merely disclose "the <u>potential for combinations</u>" but instead discloses said <u>combinations directly</u> (see the cited portion [0010] in Carcia et al);

(2) Counter to applicant's allegation that an infinite number of stoichiometric combinations can be formed is irrelevant to the claimed ternary compound: "compound" is defined as "two or more atoms joined together chemically, with covalent or ionic bonds" (see, e.g., Davis et al, "Modern Chemistry", Holt, Rinehart and Winston 1999, page 17; or Columbia Encyclopedia (<u>http://columbia.thefreedictionary.com/compound</u> (2 pages)). The number of combinations that can be built from said four binary oxides is not infinite but instead is quite finite, the possibilities being limited severely by the valency of the participating atoms. An infinity of combinations through mixing can be formed, either of the atomic building blocks (Zn, Sn and O), - which is outside of the scope of the claimed invention, or of mixtures of the binary oxides and their combinations; however, whether or not any particular mixture meets claims 1, 19, 29 and 48, or, for claims 50, 56 and claims dependent on claims 60 or 64, whether a

ternary compound containing zinc, tin and oxygen is contained therein is solely determined whether Zn_2SnO_4 or said ternary compound containing Zn, Sn and O is comprised therein.

(3) Applicant's method of manufacturing the claimed compound is RF sputtering in a oxygen-argon atmosphere (see [0002]-[0010]); Carcia et al apply "magnetron sputtering in a atmosphere of oxygen and an inert gas" (see [0018] and Examples1-7), specifically: argon (Ar) (loc.cit.). That RF magnetron sputtering indeed is capable of producing zinc stannate is known (see, e.g., Kluth et al, "Magnetron Sputtered Zinc Stannate Films for Silicon Thin Film Solar Cells", presented at the 3rd World Conference on Photovoltaic Energy Conversion (WCPEC-3), May 11-18, 2003, Osaka, Japan).

In view of the above, said first argument is not persuasive.

(b) Arguments in an apparently anticipated traverse of a *Rejection of newly added claims 50,56,60, and 64:*

A "second" argument of traverse in apparent anticipation of rejection over Carcia et al of the newly added claims, said anticipation being founded on the similarity of said newly added claims as previously cancelled claims similar in content to claims 4, 19 and 48: applicant alleges (page 16, Remarks) that the teaching by Carcia et al of four binary oxides including an indication of "the potential for combinations thereof" "would not be sufficient disclosure for one of ordinary skill to immediately envisage the specific ternary zinc-tin oxide combination". This second argument is indistinct from the first. Applicant appears to base his argument by alleging that "an infinite number of stoichiometric combinations of the four binary oxides disclosed by Carcia et al. This argument is not

persuasive because of the following considerations identical to the ones ad (1) and (2) above, i.e.::

(1) Carcia does not merely disclose "the potential for combinations" but instead discloses said combinations directly (see the cited portion [0010] in Carcia et al);

(2) Counter to applicant's allegation that an infinite number of stoichiometric combinations can be formed is irrelevant to the claimed ternary compound: "compound" is defined as "two or more atoms joined together chemically, with covalent or ionic bonds" (see, e.g., see, e.g., Davis et al, "Modern Chemistry", Holt, Rinehart and Winston 1999, page 17; or Columbia Encyclopedia (http://columbia.thefreedictionary.com/compound (2 pages)) The number of combinations that can be built from said four binary oxides is not infinite but instead is quite finite, the possibilities being limited severely by the valency of the participating atoms. A near infinity of combinations through mixing can be formed, either of the atomic building blocks (Zn, Sn and O), - which is outside of the scope of the claimed invention, or of mixtures of the binary oxides and their combinations; however, whether or not any particular mixture meets claims 1, 19, 29 and 48, or, for claims 50, 56 and claims dependent on claims 60 or 64, whether a ternary compound containing zinc, tin and oxygen is contained therein, is solely determined by whether Zn_2SnO_4 or said ternary compound containing Zn, Sn and O is comprised therein.

(3) Applicant's method of manufacturing the claimed compound is RF sputtering in a oxygen-argon atmosphere (see [0002]-[0010]); Carcia et al apply "RF magnetron sputtering" (see [0039]-[0054 and Figure legends) in a atmosphere of oxygen and an

inert gas" (see [0018] and Examples1-7), specifically: argon (Ar) (loc.cit.). That RF magnetron sputtering indeed is capable of producing zinc stannate is known (see, e.g., Kluth et al, "Magnetron Sputtered Zinc Stannate Films for Silicon Thin Film Solar Cells", presented at the 3rd World Conference on Photovoltaic Energy Conversion (WCPEC-3), May 11-18, 2003, Osaka, Japan).

In view of the above, neither said first argument nor said second argument is deemed persuasive.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JPM
November 4, 2006

Patent Examiner:
Johannes Mondt (Art Unit: 3663)